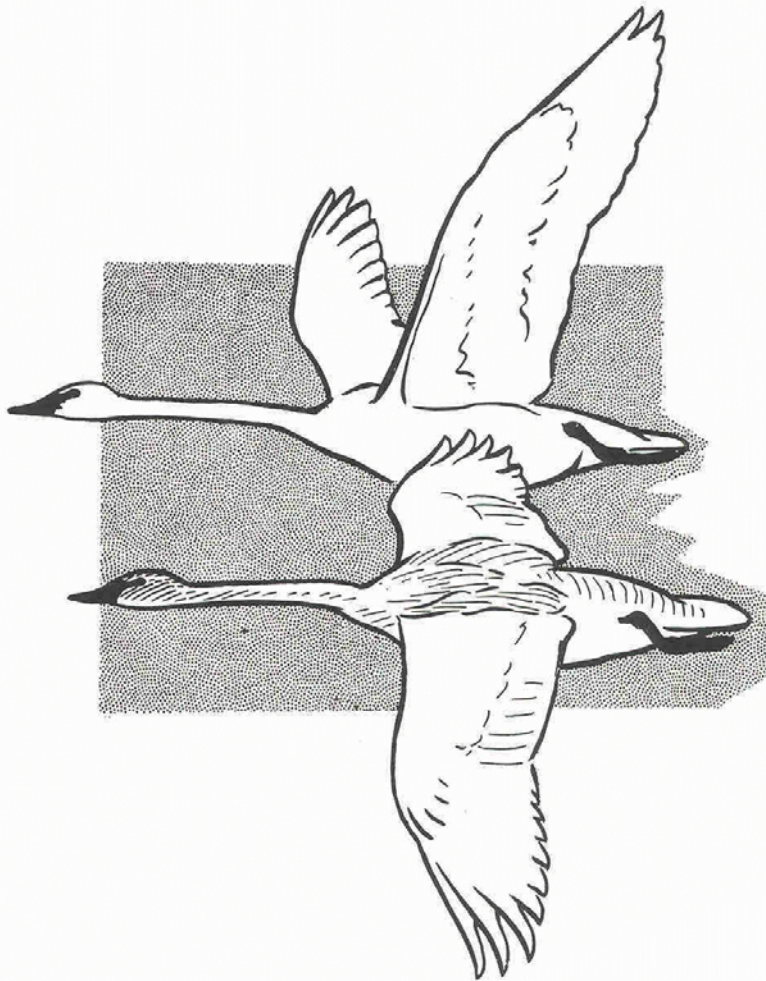


**TRUMPETER SWAN SURVEY**  
**of the**  
**ROCKY MOUNTAIN POPULATION**  
**WINTER 2005**



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WINTER 2005**

U.S. Fish and Wildlife Service  
Migratory Birds and State Programs  
Mountain-Prairie Region  
Lakewood, Colorado

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*Abstract.*— Observers counted 5,361 swans (white birds and cygnets) in the Rocky Mountain Population of trumpeter swans during February 2005, an increase of 17% from the 4,584 counted in February 2004 and the second consecutive record-high count for the Mid-winter Survey. The numbers of white birds (4,206) and cygnets (1,155) increased 10% and 53%, respectively, from counts last year. In the tri-state area, increases in total swans occurred in Idaho (+20%) and Wyoming (+25%), but decreased slightly in Montana (-7%). The number of birds wintering in areas near restoration flocks was higher than counts in recent years, largely due to more complete survey coverage in the Summer Lake WMA this winter. However, counts at Malheur NWR remained near historic lows, and the count at Ruby Lake NWR was the lowest since 1995. Drought conditions persisted in much of the tri-state area, and reservoir levels in early February remained among the lowest recorded for that time of year. Generally, temperatures during winter 2004-05 were slightly warmer than average, with short periods of cool temperatures in December. Temperatures were colder than average in western Wyoming and southern Idaho during February, but warmer than average in Montana. Precipitation in primary winter areas was well below average from December 2004 through February 2005.

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The Rocky Mountain Population (RMP) of trumpeter swans (*Cygnus buccinator*) consists of birds that nest primarily from western Canada southward to Nevada and Wyoming (Fig. 1). The population is comprised of several flocks that nest in different portions of the overall range. The RMP/Canadian Flocks consist of birds that summer primarily in southeastern Yukon Territory, southwestern Northwest Territories, northeastern British Columbia, Alberta, and western Saskatchewan. The RMP/Tri-state Area Flocks summer in areas at the juncture of the boundaries of Montana, Wyoming, and Idaho (hereafter termed the tri-state area) and nearby areas (Fig. 2). The Canadian and Tri-state Area flocks winter sympatrically primarily in the tri-state area. In addition, efforts have been made to establish several RMP restoration flocks, such as those at Ruby Lake National Wildlife Refuge (NWR) in Nevada (i.e., Nevada flock) and those at Malheur NWR and Summer Lake Wildlife Management Area (WMA) and vicinity (i.e., Oregon flock), by translocating adult swans and cygnets from other portions of the RMP. These birds tend to winter in areas near those where they nest. These terms for the various groups of swans are consistent with the RMP Trumpeter Swan Implementation Plan (Pacific Flyway Study Committee 2002).

Although counts of swans wintering in the tri-state area have been conducted since at least the 1950s (Banko 1960), many early efforts were not well-coordinated and were variable. In an attempt to better coordinate the survey, in 1972 the U.S. Fish and Wildlife Service (Service) began the annual Mid-winter Trumpeter Swan Survey in the tri-state region. During the next decade, the area surveyed increased substantially, and by 1981 it was believed all known occupied wintering sites were included (Gale et al. 1988). Recent attempts to expand the wintering range of RMP trumpeter swans has resulted in the inclusion of yet more areas to the survey. Also, some areas may not be surveyed in a particular year due to weather or resource limitations (e.g., staff, money). Such survey modifications make individual counts from year-to-year less comparable, but the data are sufficient to reasonably depict trends in abundance.



Fig. 1. Approximate ranges of trumpeter swans during summer (from Caithamer 2001).



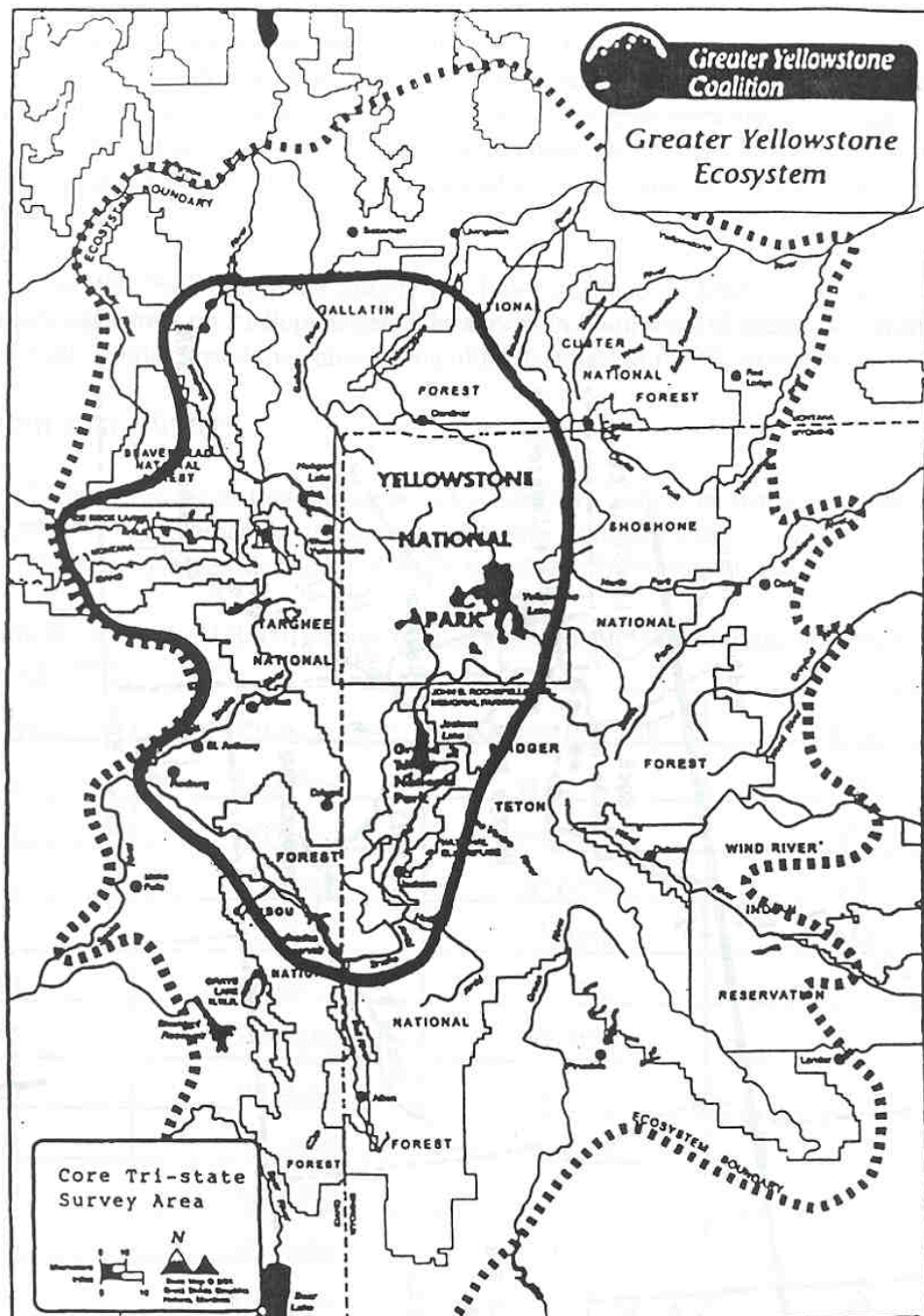


Fig. 2. Map showing the 'core' tri-state area of southeast Idaho, southwest Montana, and northwest Wyoming (provided by the Greater Yellowstone Coalition, Bozeman, Montana).

The Mid-winter Trumpeter Swan Survey is conducted annually in February. The survey is conducted cooperatively by several administrative entities and is intended to provide an annual assessment of the number of RMP trumpeter swans. Only data from 1972 to present, the time frame during which the Service has coordinated the survey, were analyzed for this report.

## METHODS

The survey generally is conducted within a relatively short time frame (i.e., 1 week) to reduce the possibility of counting swans more than once due to movements of birds among areas. Aerial cruise surveys are used to count numbers of swans in the tri-state area, Nevada, and in the Summer Lake WMA and vicinity; ground surveys are used to count the number of swans at Malheur NWR and in isolated pockets of habitat not covered by aerial surveys. During aerial surveys, data are collected by observers seated in a single-engine, fixed-winged aircraft. Flying altitude varies with changes in terrain and surface winds, but generally averages 30-60 m above ground level, and flight speed is between 135-155 kph. One to two observers and the pilot count white (i.e., adults and subadults) and gray (i.e., cygnets) swans in known or suspected habitats. Counts are not adjusted for birds present but not seen by aerial crews, and have an unknown and unmeasured sampling variance associated with them. Ground surveys are used to verify species composition of some swan flocks, because trumpeter and tundra (*C. columbianus*) swans are difficult to differentiate during aerial surveys. Efforts are made to identify and exclude tundra swans from the survey counts.

Survey coverage of the Summer Lake WMA was more complete than in the last few years. Counts for this area in some years have been low due to abbreviated surveys, but the few birds counted there (<1% of totals) have little influence on total RMP results. Although the incomplete surveys cause a slight downward bias in the total counts, we included them for analyses of total RMP counts.

Estimates of abundance for Canadian Flocks are determined by subtracting the count of the RMP/U.S. Breeding Segment in the previous fall (e.g., U.S. Fish and Wildlife Service 2004a) from the Mid-winter count. For the estimate of the size of the Canadian Flocks to be accurate, several conditions must be met. First, all swans must be correctly identified to species. Second, the Mid-winter count and the fall count of swans in the RMP/U.S. Breeding Segment must be accurate. Additionally, we must assume that mortality in the RMP/U.S. Breeding Segment between the time of the fall and winter surveys is negligible. Because of problems inherent in surveying biological populations, these conditions probably are seldom met. Thus, this methodology for estimating the size of the RMP/Canadian Flocks likely leads to somewhat biased estimates of the composition of the RMP. However, we assume that these possible inaccuracies, if they occur, are random. We believe the estimates provided in this report are reasonable indices to flock-specific abundances.

To assess production for the RMP, we calculated the percentage of annual total swan counts that were cygnets. However, surveys in Nevada and Oregon did not separate counts into white birds and cygnets until 1992. Therefore, to allow an assessment over a longer time frame with data that are relatively comparable from year-to-year, we used only information from birds counted in the tri-state

region. This subset contained a large majority (range = 87%-99%,  $\bar{x}$  = 95%) of the total RMP counts during 1972-2004. Counts used for analyses in this report are provided in Appendix A.

## RESULTS AND DISCUSSION

The 2005 Mid-winter survey was conducted between 25 January and 7 February; the tri-state portion of the survey was completed between 31 January and 4 February. Weather conditions during surveys were favorable in all areas. Generally, skies were clear to slightly overcast with light winds and good-to-excellent visibility. Approximately 30 h of flight time and additional ground survey time were required to complete the survey. Most of the areas typically visited during the Mid-winter survey were surveyed this year.

Habitats continued to be quite dry during winter, and much of the tri-state area remained in a drought. Water levels at 5 reservoirs (American Falls, Island Park, Jackson Lake, Palisades, and Minidoka Dam/Lake Walcott) cumulatively were at only 40% of storage capacity on February 1 (data from U.S. Bureau of Reclamation 2005a), among the lowest levels recorded during the 34-year period of surveys (Fig. 3). Together, these reservoirs comprise about 97% of the reservoir capacity for reservoirs listed in the Snake River Basin in eastern Idaho and extreme western Wyoming (U.S. Bureau of Reclamation 2005b). Precipitation was below-average in much of the tri-state area during winter 2004-05, and snowpack as of 1 February was about 50-89% of normal (U.S. Department of Agriculture 2005).

The average streamflow below Island Park Reservoir during 15 January to 15 February was only 194 cfs, 51% below the 1972-2004 average for that recording station (U.S. Bureau of Reclamation 2005a). Generally, temperatures in the tri-state area during winter were slightly warmer than average (Fig. 4), although intermittent cool periods occurred in December. During February, temperatures in western Wyoming and southern Idaho were colder than average, but were much warmer than average in Montana (Joint Agricultural Weather Facility 2005).

### Historical Trends

Methods used to estimate trends in rates of change in RMP abundance were detailed in a previous report (U.S. Fish and Wildlife Service 2003), and will not be reiterated here. Briefly, however, we used least-squares regression on log-transformed counts to assess rates of change in counts of swans over time. Counts from the current Mid-winter survey (2005) were compared to results from 1972-2004, a practice used in Service survey reports for other waterfowl (e.g., Wilkins and Otto 2004, U.S. Fish and Wildlife Service 2004b). Because Nevada and Oregon did not separate total counts of swans into white birds and cygnets prior to 1992 (see above), analyses to assess trends for white birds and cygnets used only counts from the tri-state area.

The counts for total swans of the RMP suggested an increase ( $P < 0.01$ ) of about 5.9% per year during 1972-2004 (Table 1, Fig. 5). The number of white birds (+6.0% per year) and cygnets (+5.8% per year) counted in the tri-state region increased ( $P < 0.01$ ) at similar rates. Counts of birds

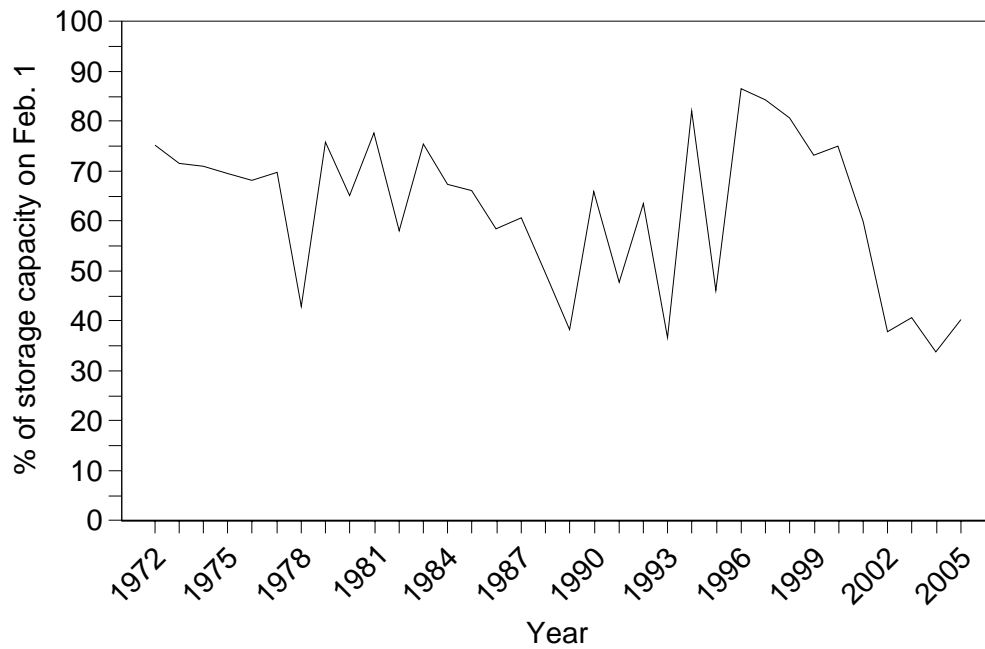


Fig. 3. Water storage for 5 reservoirs (see text) in the tri-state region on 1 February.

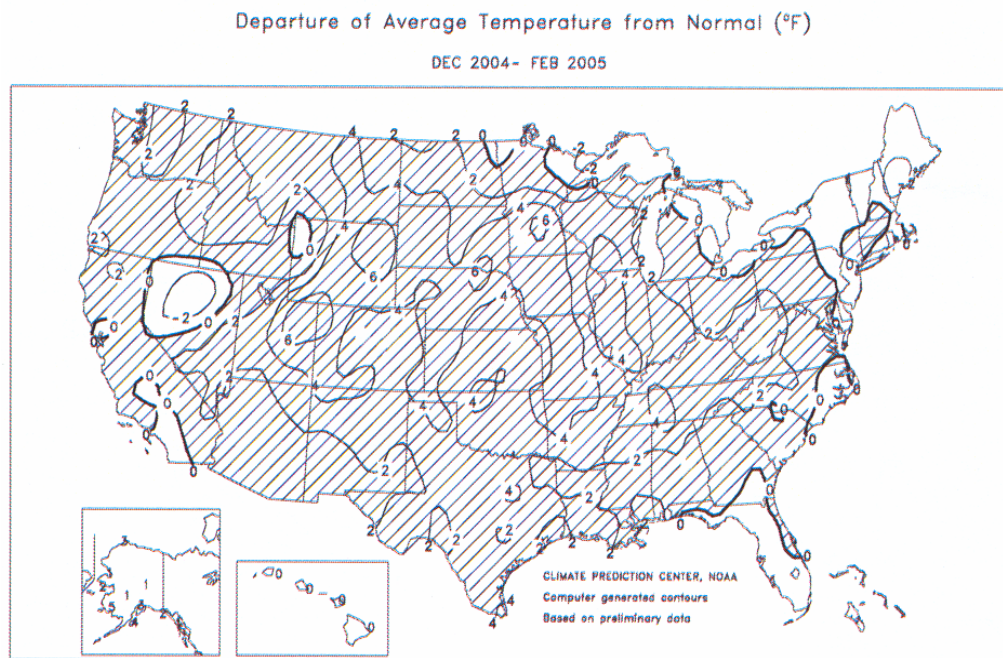


Fig. 4. Departure of temperatures from normal during winter 2004-05 (Joint Agricultural Weather Facility 2005).



in Montana (white birds + cygnets) increased slightly (+1.7% per year,  $P [\beta > 0] = 0.01$ ), whereas rates of growth for birds wintering in Idaho and Wyoming were much higher (+7.5% per year for each state)(Table 2, Fig. 6). Although the number of birds wintering in each of the 3 states in the tri-state region generally have increased since 1972, the distribution of birds among the states has changed substantially. Whereas during the 1970s and early 1980s about 36% of wintering swans were counted in Montana, only about 13% of the birds wintering in the tri-state area have been counted there during the last decade (Fig. 7). In contrast, the percentage of birds in Idaho has increased from about 53% to about 68% during that same time period. The percentage of birds counted in Wyoming during winter also has increased slightly, from about 11% to 19%.

Counts of total swans wintering in Nevada have fluctuated over time, but suggest an increase ( $P = 0.03$ ) of about 1.4% per year during 1972-2004 (Table 2, Fig. 8). Counts in Nevada since 2000 generally have been near historic highs. Trumpeter swans in Oregon primarily occur in 2 areas, Malheur NWR and the Summer Lake WMA and vicinity. Introductions of trumpeter swans to Malheur NWR began in the late 1930s, whereas birds were not translocated to Summer Lake WMA until the winter of 1992. Analyzing trends for the Oregon Flock as a whole (Table 2) could lead to inappropriate inferences. Therefore, we analyzed data for Malheur NWR (1972-2004) separate from those for Summer Lake WMA. Results suggest a decline (-2.6% per year,  $P = 0.05$ ) for birds wintering at Malheur NWR (Fig. 8, Appendix A). At Summer Lake WMA, most birds were translocated to the area during winter, and generally remained in the area for only a few months after being translocated (M. St. Louis, personal communication). Thus, in 1997, the winter following the termination of translocations to Summer Lake WMA, the number counted during the survey dropped sharply (Fig. 8). From 1997-2004, an average of about 25 birds have been observed during winter surveys (excluding years with incomplete surveys).

The percentage of the entire RMP estimated to be comprised of Canadian Flocks increased from about 19% during February of 1972 to almost 91% during February 2004 (Table 3). The data fit a 2nd-order logarithm model ( $P < 0.01$ , adjusted  $R^2 = 0.96$ ), suggesting that the percentage may be approaching a plateau value near 90% (Fig. 9). The number of swans estimated to be from Canadian Flocks exhibited a fairly steady increase since the early 1980s, and was nearly 4,200 birds in 2004 (Table 3, Fig. 9).

## **Results from the 2005 survey**

During February 2005, observers counted 5,361 trumpeter swans in the RMP, an increase of 17% from the count of last February (4,584) and the second consecutive record-high count for the Mid-winter Survey (Table 1). The number of white birds and cygnets increased 10% and 53%, respectively, from counts last year. The number of swans wintering in the tri-state area increased 17%, which also was the second consecutive record-high count. Increases of total swans from counts in 2004 occurred in Idaho (+20%) and Wyoming (+25%), but a slight decrease occurred in Montana (-7%) (Table 2). In Idaho and Wyoming, the number of birds this year were record-high counts. Of the birds wintering in the tri-state area during February 2005, about 12% were in Montana, 71% were in Idaho, and 17% inhabited Wyoming.

Table 1. Counts of trumpeter swans of the Rocky Mountain Population during winter, 1972-2005.

Year	Tri-state area			Oregon and Nevada <sup>a</sup>			Total RMP		
	White birds	Cygnets	Total	White birds	Cygnets	Total	White birds <sup>b</sup>	Cygnets <sup>b</sup>	Total
1972	c	c	616			91			707
1973	c	c	581 <sup>d</sup>			60			641
1974	553	156	709			61			770
1975	595	128	723			40			763
1976	623	102	725			55			780
1977	839	178	1017			46			1063
1978	695	179	874			27			901
1979	743	123	866			62			928
1980	767	172	939			86			1025
1981	1000	247	1247			98			1345
1982	952	266	1218			105			1323
1983	1025	207	1232			90			1322
1984	1128	332	1460			98			1558
1985	1326	190	1516			82			1598
1986	1304	299	1603			59			1662
1987	1196	386	1582			77			1659
1988	1314	408	1722			51			1773
1989	1452	291	1743			54			1797
1990	1591	416	2007			38			2045
1991	1589	342	1931			49			1980
1992	1642	397	2039	99	58	157	1741	455	2196
1993	1659	419	2078	121	36	157	1780	455	2235
1994	1753	543	2296	127	101	228	1880	644	2524
1995	2012	668	2680	93	30	123	2105	698	2803
1996	2129	580	2709	163	64	227	2292	644	2936
1997	2179	407	2586	77	18	95	2256	425	2681
1998 <sup>e</sup>	1756	307	2063	64	29	93	1820	336	2156
1999	2698	772	3470	45 <sup>f</sup>	10 <sup>f</sup>	71	2743 <sup>f</sup>	782 <sup>f</sup>	3541
2000	2694	746	3440	50 <sup>f</sup>	15 <sup>f</sup>	84	2744 <sup>f</sup>	761 <sup>f</sup>	3524
2001	3198	719	3917	47 <sup>f</sup>	11 <sup>f</sup>	90	3245 <sup>f</sup>	730 <sup>f</sup>	4007
2002	3814	546	4360	48 <sup>f</sup>	7 <sup>f</sup>	67	3862 <sup>f</sup>	553 <sup>f</sup>	4427
2003 <sup>g</sup>	3365	532	3897	62	15	77	3427	547	3974
2004 <sup>g</sup>	3785	746	4531	46	7	53	3831	753	4584
2005	4147	1143	5290	59	12	71	4206	1155	5361

<sup>a</sup> Total counts not separated into white birds and cygnets prior to 1992.

<sup>b</sup> Not calculated prior to 1992 because of no counts for Oregon and Nevada.

<sup>c</sup> Not provided because counts for Yellowstone National Park not separated into white birds and cygnets.

<sup>d</sup> In Wyoming only Yellowstone National Park surveyed.

<sup>e</sup> 1998 counts for the Tri-state area and Total RMP are biased low because aerial survey of Yellowstone National Park not conducted due to hazardous weather; counted by snowmobile with incomplete coverage.

<sup>f</sup> Counts biased low because white-bird and cygnet counts for Malheur NWR not available.

<sup>g</sup> Oregon/Nevada and Total RMP counts biased low due to incomplete surveys at Summer Lake WMA.

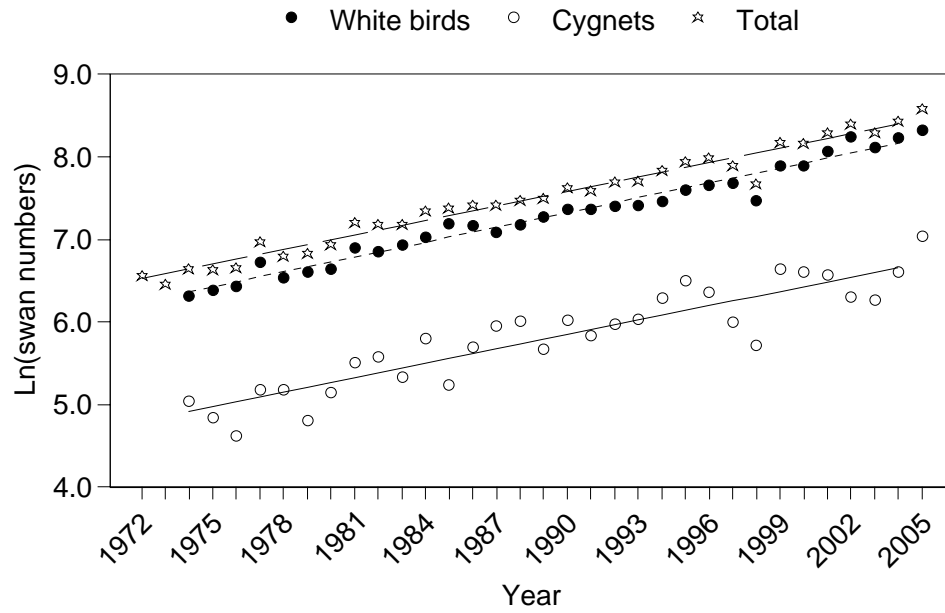


Fig. 5. Rates of change for counts of swans in the RMP during the Mid-winter Trumpeter Swan Survey, 1972-2005 (dotted and solid lines depict trends for white birds and cygnets, respectively, for swans counted in the tri-state region [see text]; dashed line depicts total RMP swans).

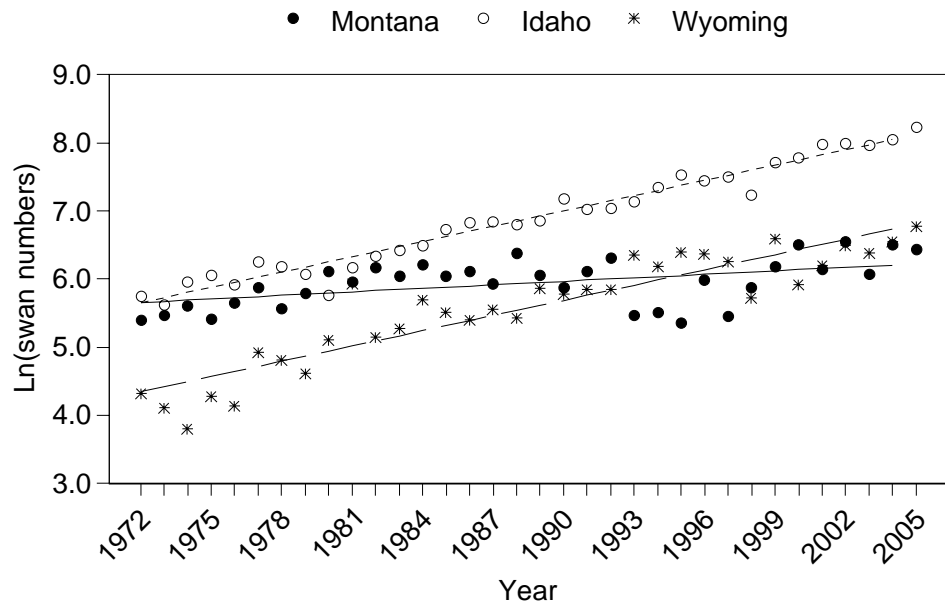


Fig. 6. Rates of change for counts of total swans in states of the tri-state region during the Mid-winter Trumpeter Swan Survey, 1972-2005 (solid, dotted, and dashed lines represent trends for Montana, Idaho, and Wyoming, respectively).

Table 2. Counts of trumpeter swans of the Rocky Mountain Population in individual states during winter, 1972-2005.

Year	Montana			Idaho			Wyoming			Oregon <sup>a</sup>			Nevada <sup>a</sup>		
	White birds	Cygnets	Total	White birds	Cygnets	Total	White birds	Cygnets	Total	White birds	Cygnets	Total	White birds	Cygnets	Total
1972	209	14	223	303	14	317	b	.b	76			50			41
1973	212	28	240	222	58	280	.b	b	61 <sup>c</sup>			32			28
1974	233	40	273	282	109	391	38	7	45			36			25
1975	192	32	224	333	94	427	70	2	72			15			25
1976	253	34	287	308	67	375	62	1	63			30			25
1977	315	43	358	395	126	521	129	9	138			17			29
1978	194	68	262	392	96	488	109	15	124			7			20
1979	304	26	330	353	81	434	86	16	102			41			21
1980	374	80	454	250	70	320	143	22	165			65			21
1981	352	36	388	370	110	480	278	101	379			77			21
1982	390	90	480	429	137	566	133	39	172			65			40
1983	363	59	422	493	122	615	169	26	195			52			38
1984	389	109	498	503	162	665	236	61	297			63			35
1985	393	31	424	701	144	845	232	15	247			51			31
1986	380	73	453	744	183	927	180	43	223			33			26
1987	314	63	377	690	255	945	192	68	260			49			28
1988	438	153	591	694	209	903	182	46	228			24			27
1989	342	90	432	817	141	958	293	60	353			36			18
1990	319	38	357	1025	300	1325	247	78	325			23			15
1991	385	70	455	918	211	1129	286	61	347			31			18
1992	438	114	552	892	249	1141	312	34	346	67	56	123	32	2	34
1993	168	70	238	1020	246	1266	471	103	574	91	36	127	30	0	30
1994	199	48	247	1164	397	1561	390	98	488	114	94	208	13	7	20
1995	153	61	214	1391	475	1866	468	132	600	72	27	99	21	3	24
1996	319	82	401	1336	390	1726	474	108	582	140	49	189	23	15	38
1997	204	30	234	1555	272	1827	420	105	525	46	9	55	31	9	40
1998	290	68	358	1200	200	1400	266 <sup>d</sup>	39 <sup>d</sup>	305 <sup>d</sup>	31	7	38	33	22	55
1999	335	153	488	1754	500	2254	609	119	728	16 <sup>e</sup>	2 <sup>e</sup>	34	29	8	37
2000	519	155	674	1881	513	2394	294	78	372	15 <sup>e</sup>	6 <sup>e</sup>	40	35	9	44
2001	373	96	469	2404	549	2953	421	74	495	16 <sup>e</sup>	7 <sup>e</sup>	55	31	4	35
2002	600	104	704	2636	357	2993	578	85	663	7 <sup>e</sup>	5 <sup>e</sup>	24	41	2	43
2003	375	58	433	2490	382	2872	500	92	592	28 <sup>f</sup>	8 <sup>f</sup>	36 <sup>f</sup>	34	7	41
2004	583	92	675	2591	563	3154	611	91	702	8 <sup>f</sup>	0 <sup>f</sup>	8 <sup>f</sup>	38	7	45
2005	508	119	627	2954	828	3782	685	196	881	27	10	37	32	2	34

<sup>a</sup> Counts for Oregon and Nevada were not separated into white birds and cygnets until 1992.

<sup>b</sup> Not provided because counts for Yellowstone National Park not separated into white birds and cygnets.

<sup>c</sup> Counts for Yellowstone National Park only; remainder of Wyoming not surveyed.

<sup>d</sup> Counts for Wyoming biased low because aerial survey of Yellowstone National Park not conducted due to hazardous weather; counted by snowmobile with incomplete coverage.

<sup>e</sup> Counts biased low because white-bird and cygnet counts for Malheur NWR not available.

<sup>f</sup> Counts biased low due to incomplete surveys at Summer Lake WMA.

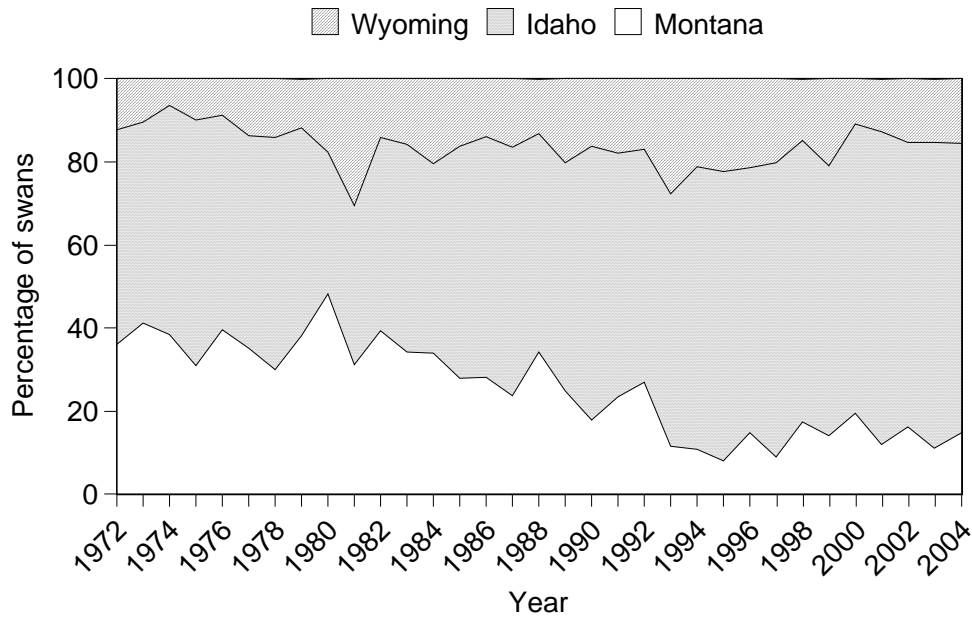


Fig. 7. Proportions of total swans counted in each of the states comprising the tri-state region during the Mid-winter Trumpeter Swan Survey, 1972-2004.

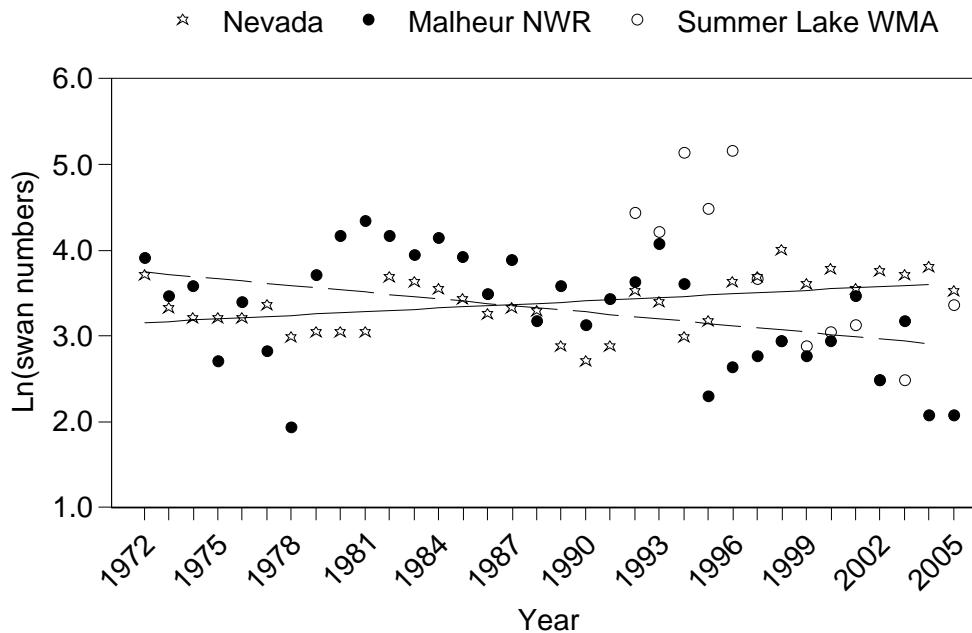


Fig. 8. Rates of change in counts of total swans in Nevada (stars and solid line) and Oregon (Malheur NWR [closed circles and dashed line] and Summer Lake WMA [open circles]) during the Mid-winter Trumpeter Swan Survey, 1972-2005. Data for Summer Lake WMA in 2002 and 2003 are from incomplete surveys.



Table 3. Estimates of swan abundance for flocks comprising the Rocky Mountain Population of Trumpeter swans, 1972-2005.

Year	Mid-winter count	U.S. Breeding Flocks <sup>a</sup>	Canadian Flocks	Percent Canadian Flocks
1972	707	572	135	19.1
1975	763	581	182	23.9
1978	901	544	357	39.6
1981	1345	582	763	56.7
1984	1558	547	1011	64.9
1985	1598	563	1035	64.8
1986	1662	575	1087	65.4
1987	1659	452	1207	72.8
1988	1773	611	1162	65.5
1989	1797	659	1138	63.3
1990	2045	598	1447	70.8
1991	1980	626	1354	68.4
1992	2196	555	1641	74.7
1993	2235	563	1672	74.8
1994	2524	354	2170	86.0
1995	2803	454	2349	83.8
1996	2936	427	2509	85.5
1997	2681	458	2223	82.9
1998	2156	427	1729	80.2
1999	3541	469	3072	86.8
2000	3524	417	3107	88.2
2001	4007	481	3526	88.0
2002	4427	487	3940	89.0
2003	3974	371	3603	90.7
2004	4584	417	4167	90.9
2005	5361	417	4944	92.2

<sup>a</sup> From U.S. Fish and Wildlife Service 2004a. Counts are from the previous calendar year (e.g., the 2005 value is from the Fall 2004 survey).

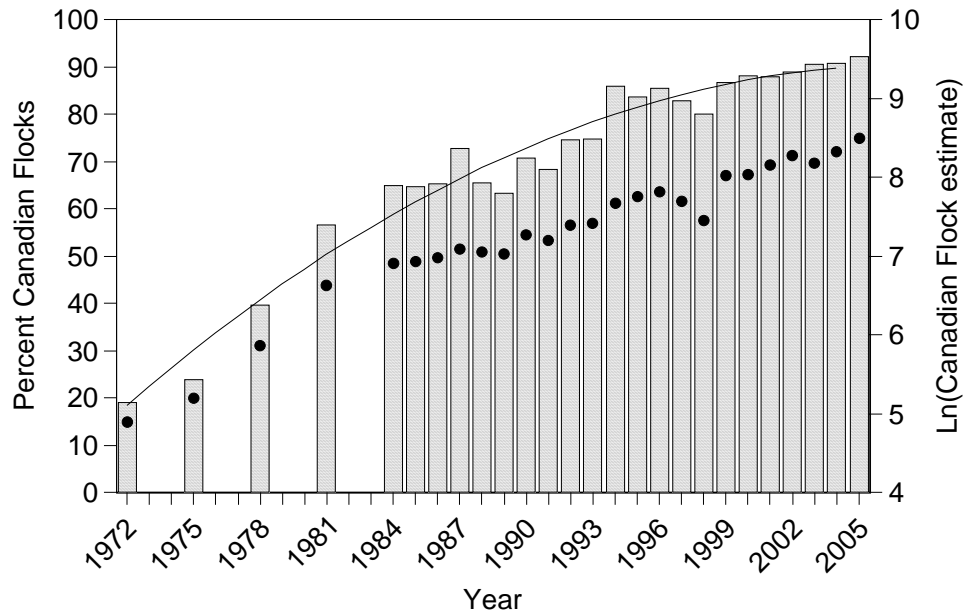


Fig. 9. Percent (bars and solid line) and counts (solid dots) of the entire RMP estimated to be comprised of Canadian Flocks during the Mid-winter Trumpeter Swan Survey, 1972-2005.

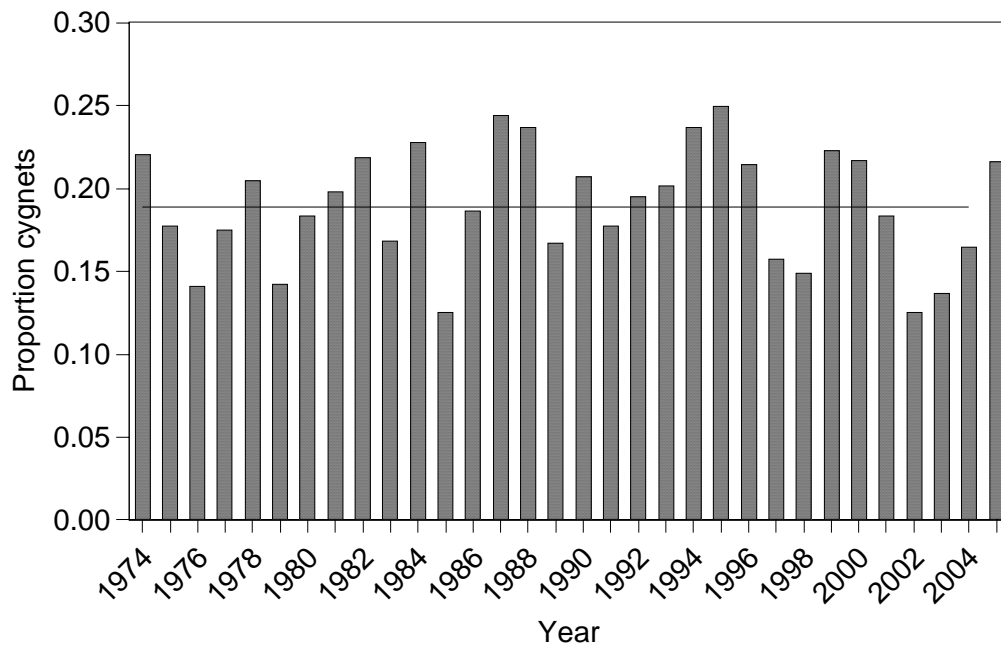


Fig. 10. Proportion of cygnets counted in the tri-state region during the Mid-winter Trumpeter Swan Survey, 1974-2005. The solid line depicts the 1974-2004 average.

The number of swans in Nevada (34) was lower than counts in recent winters (Table 2). The count for cygnets was very low, due in part to the lack of local production the previous summer. Nonetheless, the total count was 10% above the long-term average. Weather conditions were normal during the survey, providing limited open water in several areas. Swans usually arrive at Ruby Lake NWR in December, but for the second consecutive year these early winter counts have been well-below average. The number of swans counted at Malheur NWR (8) was the same as last year, which was the lowest recorded in 25 years (Appendix A).

Our index suggested about 92% of the RMP counted in February 2005 was comprised of swans from Canadian Flocks (Table 3, Fig. 9). This value is slightly higher than those from the last few years (~90%). The estimated number of swans from Canadian Flocks was 4,944 birds, a value dramatically higher (+19%) than that of 2004. With the exception of 2003, successive estimates for the size of the Canadian Flocks since 1998 have been record-high counts.

The proportion of cygnets for swans counted in the tri-state region during February 2005 was 0.2161. This value was 15% above the 1974-2004 average (0.1887) (Fig. 10). The 2005 Mid-winter proportion was the first year since 2000 suggesting above-average production for the RMP.

In summary, RMP trumpeter swans appeared to increase by about 5.9% annually between 1972 and 2004. Most of the increase over that time was attributable to increases in the number of birds in the Canadian Flocks, which estimates suggest comprise more than 90% of the population. However, the estimates are not derived from a survey of swans in Canada, but rather from subtracting the winter count from the previous fall count of RMP swans summering in the U.S. During fall 2005, the 5-year range-wide survey of trumpeter swans will be conducted (e.g., Caithamer 2001). This survey is conducted during fall in all areas within the breeding range of trumpeter swans, providing counts for specific summering areas in the U.S. and Canada. Results from that survey will provide an opportunity to compare actual survey counts for the birds in Canada to our index.

The number of RMP swans appeared to increase 17% between the winters of 2003-04 and 2004-05. Although such an increase may be biologically possible, it is not typical of a species with a long life span and relatively low recruitment rate. The production rate for the entire RMP during spring and summer 2004 appeared to be much improved from recent years, and the index was above the long-term average for the first time since 2000. The production rate of birds nesting in the U.S. in 2004 was similar to that from 2003, but below average (U.S. Fish and Wildlife Service 2004a). Production appeared to be good during summer 2004 in Canada (correspondence from G. Beyersbergen [Canadian Wildlife Service] to C. Mitchell [Gray's Lake NWR]), but likely was insufficient to account for the entire increase suggested from the winter survey. Also, although tundra swans have been observed inhabiting the same areas as trumpeter swans during this survey, ground observations in Idaho (where the largest numbers of swans and largest aggregations are encountered) found few tundra swans mixed with trumpeter swans. Thus, the increase probably was not influenced greatly by counting tundra swans as trumpeter swans during the survey. Although survey biologists are experienced and the survey crews are very similar from year to year, problems inherent to this type of survey (i.e., cruise survey with no correction for visibility bias) potentially can influence

estimates. Perhaps a combination of these issues resulted in the apparent increase. However, we cannot rule out the possibility that the increase was real. Improvements to survey methodology would be necessary to resolve some of these issues.

Counts in restoration areas were lower than those from last year, and the count at Malheur NWR tied the lowest recorded since 1978. Data for Ruby Lake NWR suggest that birds may be exhibiting changing migration patterns, although the birds may simply be responding to relatively dry winters in the region. Additional years of information would be needed to determine whether a permanent alteration has occurred.

## **ACKNOWLEDGMENTS**

We would like to especially thank the personnel who conducted the surveys, a list of whom is provided in Appendix C. The survey is a collaborative effort among Red Rock Lakes NWR, Migratory Birds and State Programs -- Mountain-Prairie Region of the U.S. Fish and Wildlife Service, Southeast Idaho Refuge Complex, National Elk Refuge, Harriman State Park, Idaho Department of Fish and Game, Grand Teton National Park, Yellowstone National Park, Wyoming Game and Fish Department, Ruby Lake NWR, Malheur NWR, and the Shoshone-Bannock Tribes. J. Cornely, T. McEneaney, J. Mackay, C. Mitchell, S. Patla, R. Roy, M. St. Louis, and J. Warren provided comments and helpful suggestions on previous drafts of this document.

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Appendix A. Counts of trumpeter swans of the Rocky Mountain Population during winter, 1972-2005.

Year	Montana			Idaho			Wyoming (outside Yellowstone NP)		
	White birds	Cygnets	Total	White birds	Cygnets	Total	White birds	Cygnets	Total
1972	209	14	223	303	14	317	16	4	20
1973	212	28	240	222	58	280	a	a	a
1974	233	40	273	282	109	391	7	0	7
1975	192	32	224	333	94	427	40	2	42
1976	253	34	287	308	67	375	30	1	31
1977	315	43	358	395	126	521	86	0	86
1978	194	68	262	392	96	488	63	4	67
1979	304	26	330	353	81	434	15	3	18
1980	374	80	454	250	70	320	63	6	69
1981	352	36	388	370	110	480	37	10	47
1982	390	90	480	429	137	566	76	19	95
1983	363	59	422	493	122	615	81	12	93
1984	389	109	498	503	162	665	87	11	98
1985	393	31	424	701	144	845	78	8	86
1986	380	73	453	744	183	927	91	25	116
1987	314	63	377	690	255	945	85	18	103
1988	438	153	591	694	209	903	115	28	143
1989	342	90	432	817	141	958	197	39	236
1990	319	38	357	1025	300	1325	169	46	215
1991	385	70	455	918	211	1129	225	47	272
1992	438	114	552	892	249	1141	204	30	234
1993	168	70	238	1020	246	1266	293	64	357
1994	199	48	247	1164	397	1561	253	74	327
1995	153	61	214	1391	475	1866	327	91	418
1996	319	82	401	1336	390	1726	344	84	428
1997	204	30	234	1555	272	1827	346	102	448
1998	290	68	358	1200	200	1400	109	15	124
1999	335	153	488	1754	500	2254	317	71	388
2000	519	155	674	1881	513	2394	207	65	272
2001	373	96	469	2404	549	2953	368	63	431
2002	600	104	704	2636	357	2993	447	72	519
2003	375	58	433	2490	382	2872	354	58	412
2004	583	92	675	2591	563	3154	462	58	520
2005	508	119	627	2954	828	3782	561	166	727

<sup>a</sup> Counts not available.

<sup>b</sup> Total counts not separated into white birds and cygnets prior to 1992.

<sup>c</sup> Swans first translocated to Summer Lake WMA in 1992.

<sup>d</sup> Count biased low because aerial survey not conducted due to hazardous weather; snowmobile count with incomplete coverage only.

<sup>e</sup> Count biased low due to incomplete survey coverage.

Appendix A. (cont.)

Year	Yellowstone NP			Malheur NWR <sup>b</sup>			Summer Lake WMA <sup>c</sup>			Nevada <sup>b</sup>		
	White birds	Cygnets	Total	White birds	Cygnets	Total	White birds	Cygnets	Total	White birds	Cygnets	Total
1972	a.	a.	56			50						41
1973	a	a	61			32						28
1974	31	7	38			36						25
1975	30	0	30			15						25
1976	32	0	32			30						25
1977	43	9	52			17						29
1978	46	11	57			7						20
1979	71	13	84			41						21
1980	80	16	96			65						21
1981	241	91	332			77						21
1982	57	20	77			65						40
1983	88	14	102			52						38
1984	149	50	199			63						35
1985	154	7	161			51						31
1986	89	18	107			33						26
1987	107	50	157			49						28
1988	67	18	85			24						27
1989	96	21	117			36						18
1990	78	32	110			23						15
1991	61	14	75			31						18
1992	108	4	112	25	13	38	42	43	85	32	2	34
1993	178	39	217	44	15	59	47	21	68	30	0	30
1994	137	24	161	30	7	37	84	87	171	13	7	20
1995	141	41	182	9	1	10	63	26	89	21	3	24
1996	130	24	154	11	3	14	129	46	175	23	15	38
1997	74	3	77	11	5	16	35	4	39	31	9	40
1998	157 <sup>d</sup>	24 <sup>d</sup>	181 <sup>d</sup>	13	6	19	18	1	19	33	22	55
1999	292	48	340	a	a	16	16	2	18	29	8	37
2000	87	13	100	a	a	19	15	6	21	35	9	44
2001	53	11	64	a	a	32	16	7	23	31	4	35
2002	131	13	144	a	a	12	7 <sup>e</sup>	5 <sup>e</sup>	12 <sup>e</sup>	41	2	43
2003	146	34	180	19	5	24	9 <sup>e</sup>	3 <sup>e</sup>	12 <sup>e</sup>	34	7	41
2004	149	33	182	8	0	8	a	a	a	38	7	45
2005	124	30	154	8	0	8	19	10	29	32	2	34

<sup>a</sup> Counts not available.

<sup>b</sup> Total counts not separated into white birds and cygnets prior to 1992.

<sup>c</sup> Swans first translocated to Summer Lake WMA in 1992.

<sup>d</sup> Count biased low because aerial survey not conducted due to hazardous weather; snowmobile count with incomplete coverage only.

<sup>e</sup> Count biased low due to incomplete survey coverage.

Appendix B. Site-specific counts of trumpeter swans of the Rocky Mountain Population during the Mid-winter Trumpeter Swan Survey, 2005.

State or Area	White birds	Cygnets	Total	Pilot/observer/notes
<b>Montana</b>				
<i>Hebgen Lake area</i>				P: R. Stradley, O: T. McEneaney; 1/31/2005
Cougar Creek	0	0	0	
Between Quake Lake and Hebgen Lake	0	0	0	
Madison River Arm	217	33	250	
North Spring (Grayling Arm)	26	14	40	
South Fork Arm	124	25	149	
<b>Subtotal</b>	<b>367</b>	<b>72</b>	<b>439</b>	
<i>Madison River Valley</i>				P: D. Chapman, O: J. Warren; 2/3/2005
Odell Creek Area	0	0	0	
Walsh Ponds (south)1	0	0	0	
Walsh Ponds (north)1	3	4	7	
Madison River, south of Ennis	10	8	18	
Ennis Lake	91	29	120	
<b>Subtotal</b>	<b>104</b>	<b>41</b>	<b>145</b>	
<i>Chain of Lakes</i>				
Cliff Lake	2	0	2	
Wade Lake	0	0	0	
Goose Lake	0	0	0	
Smith Creek (Hidden Lake outlet)	0	0	0	
<b>Subtotal</b>	<b>2</b>	<b>0</b>	<b>2</b>	
<i>Centennial Valley/Red Rock Lakes NWR</i>				
Red Rock River below Lower Lake Dam	0	0	0	
MacDonald Pond	11	0	11	
Culver Pond	6	0	6	
Elk Springs Creek	0	0	0	
Swan Lake	0	0	0	
Shambow Pond	0	0	0	
Red Rock River, Lima	0	0	0	
<b>Subtotal</b>	<b>17</b>	<b>0</b>	<b>17</b>	
<i>Paradise Valley</i>				P: R. Stradley, O: T. McEneaney; 1/31/2005
Armstrong's Spring Creek	0	0	0	
Bailey's	0	0	0	
Brockway	0	0	0	
DePuys	4	0	4	
Brandis	4	1	5	
Nelson's Spring Creek	0	0	0	

## Appendix B. (cont.)

Sacagawea Park	0	0	0	
Yellowstone River 1 mile north of Emigrant	5	0	5	
Beaver Creek	4	3	7	
Yellowstone River - 6 mile	0	0	0	
Yellowstone River - Pray	0	0	0	
Dana's	1	2	3	
<b>Subtotal</b>	<b>18</b>	<b>6</b>	<b>24</b>	
<b>Wyoming</b>				
<i>Upper Snake River (Flagg Ranch to Wilson Bridge)</i>				P: G. Lust, O: S. Patla; 2/1-2/2005
Polecat Creek	5	3	8	Cygnets by themselves
Flagg Ranch to Jackson Lake	6	0	6	3 separate pairs
Jackson Lake	4	0	4	Pilgrim Creek area
Jackson Lake to Moran Junction	25	7	32	
Moran Junction to Deadman's	5	0	5	
Deadman's to Moose	18	3	21	
Moose to Gros Ventre Junction	9	3	12	
Gros Ventre Junction area	20	4	24	Ponds and spring creeks
Gros Ventre Junction to Wilson Bridge	10	6	16	Main river channel
Gros Ventre River, Highway 89 to Snake River	0	0	0	River frozen 50%
<b>Subtotal</b>	<b>102</b>	<b>26</b>	<b>128</b>	
<i>Gros Ventre River upriver of Kelly</i>				
Kelly Warm Springs, Grand Teton National Park	0	0	0	
Lower Slide Lake	0	0	0	Ground check
Upper Gros Ventre	0	0	0	Ground check
<b>Subtotal</b>	<b>0</b>	<b>0</b>	<b>0</b>	
<i>Lower Snake River (Wilson Bridge to Alpine)</i>				
Wilson Bridge to South Park Bridge	58	9	67	
Evan's Gravel pit ponds	0	0	0	90% frozen
South Park Bridge to Hoback	7	0	7	
North Wilson	6	3	9	Fish Creek and ponds west of river
Fish Creek, Wilson to Snake River	55	13	68	Includes Spring Creek complexes
Boyles Hill area	4	5	9	Ground count - Bill Long
Spring Creek	24	13	37	
Crane Creek	15	10	25	Includes "Ford's" previous surveys
Lower Flat Creek, Snake River to Jackson	21	9	30	
Rafter J Ponds	4	0	4	
Valley Springs, Captive Swan Pond/Pen Highway 89	0	0	0	90% frozen
Hoback to Astoria Bridge	3	0	3	
Astoria Bridge-Elbow	18	3	21	Includes Canyon Club wetlands
Elbow to Alpine/Palisades Reservoir	3	0	3	
Baily Lake	3	1	4	New site 2005

Appendix B. (cont.)

Bondurant pond near Hoback River	0	0	0	Few swans earlier in the winter
<b>Subtotal</b>	<b>221</b>	<b>66</b>	<b>287</b>	
<i>National Elk Refuge</i>				
Flat Creek main marsh	24	8	32	
Gros Ventre River, Kelly to Highway 89	14	7	21	Bill's Bayou, NER
Romney pond area	0	0	0	
Lost Spring	6	2	8	Added category 2005
<b>Subtotal</b>	<b>44</b>	<b>17</b>	<b>61</b>	
<i>Salt River (Alpine to Afton)</i>	3	0	3	Pair on Alpine Wetland
Palisades Reservoir, WY Alpine	20	0	20	
Palisades Reservoir to Freedom Road	7	0	7	
Freedom Road to Narrows	2	0	2	Flat Creek Pond
Thayne area	35	12	47	
Narrows to Grover/Auburn Highway	35	23	58	
Grover/Auburn Highway to Swift Creek	0	0	0	Frozen
Swift Creek to Headwaters	0	0	0	Frozen
<b>Subtotal</b>	<b>102</b>	<b>35</b>	<b>137</b>	
<i>Pinedale</i>				
New Fork Boulder to Pinedale	0	0	0	
Daniel Fish Hatchery/Forty Rod Creek	5	0	5	
<b>Subtotal</b>	<b>5</b>	<b>0</b>	<b>5</b>	
<i>Green River (Warren Bridge to Highway 28 Bridge)</i>				
Fontenelle Dam-CCC Bridge	0	0	0	
CCC Bridge to Pilot Farm	39	12	51	
Pilot Farm-Refuge Headquarters	8	0	8	
Refuge to Big Sandy	3	3	6	
Big Sandy to Big Island	6	5	11	
Flaming Gorge Reservoir	a			Surveyed by air 22 Jan; no swans
<b>Subtotal</b>	<b>56</b>	<b>20</b>	<b>76</b>	
<i>Dubois area</i>				
Wind River and spring ponds, Dubois	0	0	0	Local observer's report
Dinwoody Lake	22	2	24	Ground survey, Pat Hnilinka, FWS
Bull Lake	9	0	9	Including yellow collar Y93
Wind River, Crowhart to Burris	0	0	0	
<b>Subtotal</b>	<b>31</b>	<b>2</b>	<b>33</b>	
<i>Yellowstone National Park</i>				P: R. Stradley, O: T. McEneaney; 1/31/2005
Slough Creek	1	0	1	
Tern Lake	9	0	9	
Beach Springs Lagoon	2	0	2	



## Appendix B. (cont.)

Shoshone Geyser Basin	0	0	0	
Lewis River	4	1	5	
Buela Lake	2	0	2	
Yellowstone River	28	1	29	
Shoshone Geyser Basin	0	0	0	
Lewis - Shoshone Channel	10	1	11	
Shoshone Lake	0	1	1	
Bechler Lake	27	5	32	
Firehole River	5	3	8	
Madison River	30	16	46	
Gibbon Meadow	2	2	4	
Nymph Lake	0	0	0	
Elk Park	2	0	2	
North Twin Lake	2	0	2	
<b>Subtotal</b>	<b>124</b>	<b>30</b>	<b>154</b>	
<b>Idaho</b>				P: G. Lust, O: C. Mitchell; 2/2-4/2005
<i>Island Park Area</i>				
Warm Springs (west side of Henrys Lake)	0	0	0	100% frozen
Henrys Lake flats	14	15	29	
Big Springs, North Fork, Mack's Inn Area	28	9	37	
Mack's Inn to Island Park Reservoir	20	3	23	Microwave tower
Island Park Reservoir	0	0	0	
Island Park Reservoir inlet	44	2	46	
Trude Ranch Pond	0	0	0	100% frozen
Icehouse Reservoir	0	0	0	100% frozen
Sheridan Creek, mouth to Sheridan Reservoir	0	0	0	100% frozen
Sheridan Reservoir	9	5	14	90% frozen
Sheridan Creek cabin and pond	0	0	0	95% frozen
<b>Subtotal</b>	<b>115</b>	<b>34</b>	<b>149</b>	
<i>Buffalo River Area</i>				
Buffalo River	8	5	13	
Tom's Creek	0	0	0	
Elk Creek/Trudes Siding pond	12	1	13	
<b>Subtotal</b>	<b>20</b>	<b>6</b>	<b>26</b>	
<i>Harriman State Park (HSP) Area</i>				
Island Park Dam through Box Canyon	1	1	2	
Box Canyon - HSP north boundary	194	32	226	
HSP north bounday - Osborne bridge	36	15	51	
Golden Lake	38	4	42	80% frozen
Thurmon Creek	0	0	0	
Silver Lake	33	3	36	At outlet; lake 99% frozen
Osborne Bridge - Pinehaven	100	23	123	

Appendix B. (cont.)

Pinehaven	54	5	59	
Fish Pond	0	0	0	90% frozen
Henrys Fork below Pinehave - Forest boundary	12	16	28	
<b>Subtotal</b>	<b>468</b>	<b>99</b>	<b>567</b>	
<i>Henrys Fork, HSP to Warm River</i>				
Warm River	0	0	0	
<b>Subtotal</b>	<b>0</b>	<b>0</b>	<b>0</b>	
<i>Lower Henrys Fork Area</i>				
Forest boundary to Ashton Dam	4	2	6	River frozen ~1 mile above dam
Ashton Dam to Chester Dam	95	41	136	Tower
Chester Dam to Highway 33	160	64	224	4 swans in field
Highway 33 - Menan Buttes	170	65	235	8 swans in field
Ashton Ponds	0	0	0	100% frozen
Willow Creek Area farmstead ponds	0	0	0	100% frozen
Mikesell Reservoir 1 & 2	0	0	0	100% frozen
Arcadia Reservoir, Upper	0	0	0	100% frozen
Arcadia Reservoir, Lower	0	0	0	100% frozen
Sand Creek WMA and area	0	0	0	
Singleton Ponds	0	0	0	100% frozen
Texas Slough	0	0	0	100% frozen
Bannock Jim Slough	0	0	0	
Mud Lake WMA	0	0	0	100% frozen
Camas NWR	0	0	0	100% frozen
Camas Creek	0	0	0	90% frozen
<b>Subtotal</b>	<b>429</b>	<b>172</b>	<b>601</b>	
<i>Teton River Basin</i>				
Teton River to Wilford Dam	98	18	116	
Wilford Dam to Newdale Bridge	282	71	353	223 swans in field
Newdale Bridge to Teton Dam site	26	12	38	Powerlines
Teton River Canyon	77	6	83	Powerlines
Teton Basin	131	29	160	
North Fork Teton River	4	4	8	~50% frozen
South Fork Teton River	2	2	4	
<b>Subtotal</b>	<b>620</b>	<b>142</b>	<b>762</b>	
<i>South Fork of the Snake River</i>				
Swan Valley (Palisades Reservoir to Conant Valley)	313	84	397	317 swans in field
Canyon (Conant to Heise)	41	10	51	Powerlines
Delta (Heise to Menan Buttes)	15	4	19	Powerlines
<b>Subtotal</b>	<b>369</b>	<b>98</b>	<b>467</b>	
<i>Main Stem of the Snake River</i>				
Menan Buttes to Idaho Falls	370	118	488	

Appendix B. (cont.)

Dry Bed	2	1	3	Powerlines
Idaho Falls to Fort Hall (Ferry Butte)	9	3	12	Idaho Falls and Blackfoot airports
Blackfoot Marsh	0	0	0	Mostly dry and 100% frozen
<b>Subtotal</b>	<b>381</b>	<b>122</b>	<b>503</b>	
<i>Fort Hall Bottoms to American Falls Reservoir</i>				Powerlines; Pocatello Airport
American Falls Reservoir shoreline	0	0	0	
Kinney Creek	0	0	0	
Mouth of Portneuf River	204	57	261	
Spring Creek to American Falls Reservoir	0	0	0	
Snake River - Tilden Bridge	0	0	0	
Clear Creek and Ross Fork	1	0	1	
Diggie Creek	1	0	1	
Flying Y oxbows	1	0	1	
<b>Subtotal</b>	<b>207</b>	<b>57</b>	<b>264</b>	
<i>Fort Hall Bottoms to American Falls Reservoir</i>				
Springfield Reservoir	0	0	0	
American Falls Reservoir (except Fort Hall)	253	60	313	All in northwest corner
American Falls Dam - Minidoka NWR	0	0	0	Powerlines
Minidoka Dam - C.J. Strike Reservoir				
Bruneau Dunes State Park				
Bruneau Dunes - C.J. Stike Reservoir				
Faulkner Pond				
White Arrow Pond (Bliss)				
Pioneer Reservoir (King Hill)				
Silver Creek (Picabo area)	12	2	14	Data from B. Sturges, personal communication
<b>Subtotal</b>	<b>265</b>	<b>62</b>	<b>327</b>	
<i>Grays Lake NWR Area</i>				
Big Springs	0	0	0	100% frozen
Shorty's Homestead	0	0	0	100% frozen
Blackfoot Reservoir	32	6	38	99% frozen except small strip on northeast side
Chub Springs, southwest of refuge	0	0	0	
Chesterfield	0	0	0	100% frozen
<b>Subtotal</b>	<b>32</b>	<b>6</b>	<b>38</b>	
<i>Soda Springs Area</i>				
Woodall Springs	2	1	3	
Alexander Reservoir and Siding	10	3	13	99% frozen except at mouth of Soda Creek
Miller Ponds	6	0	6	Powerlines
Government Dam	9	4	13	Powerlines
Soda Creek	0	0	0	Powerlines
Soda Canal	0	0	0	
<b>Subtotal</b>	<b>27</b>	<b>8</b>	<b>35</b>	

Appendix B. (cont.)

<i><b>Bear River Reaches</b></i>				
Alexander Reservoir - Bear Lake NWR	0	0	0	All frozen except 1-mile strip west of Georgetown
Alexander Reservoir - Gentile Valley Bridge	12	3	15	
Gentile Valley Bridge - old cheese factory	0	0	0	
Gentile Valley Bridge to Oneida Dam	8	7	15	
Oneida Narrows	0	0	0	Powerlines
Oneida Narrows to Riverdale Bridge	1	12	13	
Riverdale Bridge to Utah border	0	0	0	
<b>Subtotal</b>	<b>21</b>	<b>22</b>	<b>43</b>	
<i><b>Bear Lake National Wildlife Refuge</b></i>				Powerlines
West Canal Unit	0	0	0	Frozen
Rainbow Unit	0	0	0	Frozen
Outlet Canal	0	0	0	Frozen
<b>Subtotal</b>	<b>0</b>	<b>0</b>	<b>0</b>	
<b>Nevada</b>				J. Mackay, 1/25/2005
Ruby Lake NWR	32	2	34	
<b>Oregon</b>				
<i><b>Malheur NWR</b></i>				R. Roy, 2/7/2005
Benson Pond	4	0	4	
Knox Swamp	2	0	2	
Mud Creek Pond	2	0	2	
<i><b>Summer Lake Wildlife Management Area</b></i>				M. St. Louis, J. Journey 2/2/2005
Summer Lake WMA	17	10	27	
Crooked River	2	0	2	

<sup>a</sup>Blank denotes area not surveyed.

Appendix C. Personnel who conducted the 2005 Mid-winter Trumpeter Swan Survey.

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Montana (Red Rock Lakes NWR, Centennial Valley, Madison Valley)

Observers: J. Warren (Red Rock Lakes NWR)  
Pilot: D. Chapman (Montana Aircraft, Inc.)

Montana (Hebgen Lake Area and Paradise Valley)

Observer: T. McEneaney (Yellowstone National Park)  
Pilot: R. Stradley (Yellowstone National Park)

Idaho

Observer: C. Mitchell (Southeast Idaho Refuge Complex)  
Pilot: G. Lust (Mountain Air Research)

Wyoming

Observer: S. Patla (Wyoming Game and Fish Department)  
Pilot: G. Lust (Mountain Air Research)

Wyoming (Yellowstone National Park)

Observer: T. McEneaney (Yellowstone National Park)  
Pilot: R. Stradley (Yellowstone National Park)

Ruby Lake NWR and vicinity

J. Mackay (Ruby Lake NWR)

Malheur NWR

R. Roy (Malheur NWR)

Summer Lake WMA

M. St. Louis, J. Journey (Oregon Department of Fish and Wildlife)

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